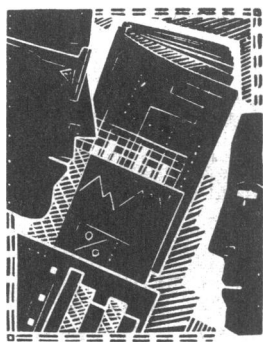


AUDIT IN PRACTICE



THIS WEEK...

• In the first article Messrs Fisher and Dearden report an audit of the management of seriously injured patients in an accident and emergency department performed in 1987 to assess the effect of changes made after an audit in 1981-2. Improvement in the error rate, which was virtually halved (from 58% to 30%), was mainly owing to improvement in the treatment of patients rather than in diagnosis and investigation and was achieved by increased participation of senior staff and by introducing a simple triage score for the junior staff to assess patients.

• Ms Lyons and Mr Gumpert use data from the first full year of audit of all inpatients of one consultant surgeon to show how much care is needed in presenting and interpreting data for audit to be effective. Generating the data is simply not sufficient.

• The commissioned article by Dr McConnachie describes the organisation of audit from its inception to its implementation in a district health authority.

Improving the care of patients with major trauma in the accident and emergency department

R B Fisher, Christine H Dearden

Abstract

Objective—To determine whether improvement in the care of victims of major trauma could be made by using the revised trauma score as a triage tool to help junior accident and emergency doctors rapidly identify seriously injured patients and thereby call a senior accident and emergency specialist to supervise their resuscitation.

Design—Comparison of results of audit of management of all seriously injured patients before and after these measures were introduced.

Setting—Accident and emergency department in an urban hospital.

Patients—All seriously injured patients (injury severity score >15) admitted to the department six months before and one year after introduction of the measures.

Results—Management errors were reduced from 58% (21/36) to 30% (16/54) ($p<0.01$). Correct treatment rather than improvement in diagnosis or investigation accounted for almost all the improvement.

Conclusions—The management of seriously injured patients in the accident and emergency department can be improved by introducing two simple measures: using the revised trauma score as a triage tool to help junior doctors in the accident and emergency department rapidly identify seriously injured patients, and calling a senior accident and emergency specialist to supervise the resuscitation of all seriously injured patients.

Implications—Care of patients in accident and emergency departments can be improved considerably at no additional expense by introducing two simple measures.

Introduction

In an analysis of the clinical management of 36 seriously injured patients during a six month period in 1981-2 we identified management errors in 21 patients (58%), including those who subsequently died, survived disabled, or made a full recovery.¹ Most errors occurred because these patients arrived outside ordinary office hours, when only inexperienced junior doctors staffed the department. These doctors often failed to recognise the severity of the patients' injuries

and consequently did not call for help from senior staff. Most mistakes were in the treatment of patients rather than the provisional diagnoses or investigations ordered, and mistakes occurred more often in cases of blunt as opposed to penetrating trauma.

As a result of this study we made several changes in our departmental policy aimed at improving the care of injured patients. Firstly, the preregistration house officers among the junior staff were replaced by senior house officers to bring the department into line with other accident and emergency departments in the United Kingdom. (The replacements, however, were mainly first year senior house officers, who were relatively inexperienced). Secondly, the failure of the more junior staff to recognise the severity of patients' injuries was overcome by using the triage version of the revised trauma score as described by Champion *et al.*² This indicates the degree of physiological upset in the vital systems caused by the injuries and is calculated from the Glasgow coma scale, systolic blood pressure, and respiratory rate and was calculated on all injured patients as soon as they arrived at the hospital. Thirdly, senior accident and emergency doctors (consultant or senior registrar grades) were called to supervise the management of patients with an abnormal revised trauma score of below 12 (box).

To assess the effects of these measures we analysed the management and outcome of severely injured patients admitted to our department during 1987.

Methods

During 1987 a prospective study was carried out on all patients admitted to the accident and emergency department of this hospital who had an injury severity score greater than 15.³ A score above 15 carries a significant risk of death^{4,5} and is generally accepted as a definition of a severely injured patient. Details of the patients' revised trauma score on arrival at hospital, the injuries diagnosed in the accident and emergency department, time spent in the department, and the grades and specialties of the attending medical staff were recorded for each patient. After patients were discharged from hospital (or died) their accident and emergency record, inpatient notes, and, where appropriate, necropsy findings were made available to the auditing panels.

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Scoring systems used in trauma

Revised trauma score

The triage version uses three physiological variables to quantify injury severity—the Glasgow coma scale, the systolic blood pressure, and the respiratory rate. Specific ranges of each variable are assigned a numerical value from 0 to 4. A score of below 4 in any one of the three variables represents a potential risk of death of greater than 10%. The revised trauma score is the sum of the three values.

Coded value	Glasgow coma score	Systolic blood pressure (mm Hg)	Respiratory rate
4	13-14	>89	>29
3	9-12	76-89	10-29
2	6-8	50-75	6-9
1	4-5	1-49	1-5
0	3	0	0

Injury severity score

This anatomic measure of injury severity requires accurate and complete knowledge of all the patient's injuries. It is calculated by assigning a score (the abbreviated injury scale code) ranging from 1 to 6 for each injury sustained by the patient: 1 represents a trivial injury (such as an abrasion) and 6 represents a fatal injury (such as decapitation). The body is divided into six regions, and the score for the most severe injury in each region is taken. The injury severity score is the sum of the squares of the three highest of these scores. For example:

Injury	Region	Abbreviated injury scale code
Laceration of larynx	Head/neck	4
Concussion	Head/neck	2
Fracture of femur	Extremities	3
Fracture of radius	Extremities	2
Fracture of rib	Thorax	1
Laceration to back	External	1
Injury severity score = 26		

AUDITING PANELS

Each patient's management in the accident and emergency department was critically assessed by two independent panels. The first panel was composed of the two accident and emergency consultants who had carried out the audit of patients in 1981-2 and were therefore able to judge patients in both groups to the same standard. The second panel was composed of a consultant surgeon and consultant intensive care anaesthetist, both of whom had worked in a level 1 trauma centre in the United States and were therefore able to compare our level of care with accepted optimal standards.

METHOD OF AUDIT

The management of the patient in the accident and emergency department was scrutinised and any errors that had been made in diagnosis, investigation, or treatment were noted. Then an overall judgment was made as to whether the errors were regarded as major or minor (that is, whether they were important in the context of patient management). In some cases major errors were thought not to have affected the clinical outcome as the injuries sustained (for example, a gunshot wound to the head) were such that survival was considered unlikely, but the management in these cases was still recorded as unsatisfactory. Minor errors such as unnecessary radiographic investigation were, in the absence of other mistakes, regarded as part of "satisfactory" management.

After audit of all cases the opinions of the two independent panels were compared and the overall results were then compared with those from the study carried out in 1981-2, which included all patients with an injury severity score >15 brought to the same accident and emergency department during a six month period. Errors in management were compared between the two groups of patients. To allow direct comparison the types of errors noted in the original study were reclassified using the more specific criteria adopted by the panels auditing cases from 1987.

Statistical analysis consisted of the χ^2 , Fisher exact, and Mann-Whitney U tests. Two tailed tests were used, and $p < 0.05$ was accepted as significant.

Results

PATIENT POPULATION

Fifty four patients with an injury severity score >15 presented during 1987; 36 patients had presented during six months in 1981-2. The average age of the patients was higher in the present study group (42.6 years compared with 31.3 years in the original study). More women with severe injuries were seen during 1987 (14; 26%) compared with 1981 (three; 8%).

AETIOLOGY AND INJURIES

The cause of the trauma was similar in the two groups (table I). Road traffic accidents were the

TABLE 1—Causes of trauma in patients admitted to accident and emergency department. Figures are number (percentage)

	1981-2 (6 months)	1987 (12 months)
Road traffic accident	17 (47)	22 (41)
Gunshot wound	13 (36)	18 (33)
Other	6 (17)	14 (26)

commonest cause, followed by gunshot wounds. The proportion of injuries due to blunt trauma rose from 55% (20/36) in 1981-2 to 63% (34/54) in 1987. The mean injury severity score in 1987 was 30.0 compared with 27.4 in 1981-2 (difference not significant), and the proportion of patients with injury severity scores ≥ 25 was virtually unchanged: 67% (24 patients) in 1981-2 and 65% (35) in 1987. The distribution of injuries according to body region affected was also similar, as was the percentage of patients with injuries confined to a single body region.

TIME OF PRESENTATION

Most of the patients arrived in the accident and emergency department outside the hours of 9 am to 5 pm: 69% (37) during 1987 compared with 78% (28) in 1981-2. The proportion of patients seen by senior accident and emergency doctors (either partly or wholly trained in accident and emergency medicine) increased from six (17%) in 1981-2 to 36 (67%) in 1987. This was due primarily to senior staff being called to see patients with serious injuries.

AUDIT FINDINGS

There was complete consensus between the two independent audit panels on the cases in which there were no errors of management and those in which the overall management was considered unsatisfactory. The panels disagreed on the overall assessment of two cases: in both cases one panel regarded the radiography as unnecessary and classified this as a minor error.

The results of the 1981-2 audit were compared with those obtained in 1987. In 1981-2, 21 of 36 cases (58%) were judged to have major errors in management. In 1987 this was reduced by almost half to 16 cases out of 54 (30%) ($\chi^2 = 7.35$, $p = 0.007$). Table II shows the



number of management errors according to grade of doctor attending the patient. Only one patient in the present study was seen initially by a preregistration house officer. To assess whether the reduction in errors of management was due to the higher number of patients seen by senior staff the proportions of satisfactory results in the senior and junior subgroups were compared to remove the influence of this factor.⁶ This resulted in a lower level of significance ($\chi^2=4.67$, $p=0.03$).

TABLE II—Number (percentage) of errors made by doctors in management of trauma patients

	1981-2 (6 months)	1987 (12 months)
Consultants or senior registrar	0/4 (0)	4/19 (21)
Registrar	1/2 (50)	5/17 (29)
Senior house officer	6/11 (55)	6/17 (35)
Junior house officer	14/19 (74)	1/1 (100)

COMPARISON OF TYPES OF ERROR

The error rate in diagnosis and investigation did not change significantly. Ten cases (19%) had diagnostic mistakes in 1987 compared with eight (22%) in 1981-2, and 14 cases (26%) had investigational errors in 1987 compared with eight (22%) in 1981-2. The principal errors that were made in 1987 were similar to those made in 1981. Correct treatment was responsible for virtually all the improvement in performance between the two studies, with only 14 out of 54 patients (26%) having an error in treatment in 1987 compared with 21 out of 36 (58%) in 1981 ($\chi^2=8.23$, $p=0.005$).

Table III shows the types of error made. There was often a link between errors in the various categories, examples being a pelvic fracture missed because of failure to perform radiography, and missed abdominal injuries due to failure to perform peritoneal lavage. The major improvements are seen to be more adequate treatment with intravenous fluids and less delay in management, which was due both to better initial management and to earlier and prompt participation of specialists.

TABLE III—Number (percentage) of errors in management of trauma patients

	1981-2 (6 months)	1987 (12 months)
<i>Diagnostic errors</i>		
Degree of head injury underestimated due to alcohol	3 (8)	3 (6)
Intra-abdominal bleeding not diagnosed	3 (8)	3 (6)
Intrathoracic injury not diagnosed	1 (3)	2 (4)
Fracture not diagnosed	2 (6)	3 (6)
<i>Investigation errors</i>		
Peritoneal lavage not performed	4 (11)	5 (9)
No blood gas analysis	5 (14)	3 (6)
Essential x ray not taken	1 (3)	5 (9)
<i>Treatment errors</i>		
Inadequate volume replacement	8 (22)	3 (6)
Failure to intubate patient	4 (11)	4 (7)
Failure to drain chest	2 (6)	3 (6)
Delay in management	11 (30)	5 (9)

ASSESSING PREVENTABLE DEATHS

The management of the patients was studied to assess which deaths might have been prevented. A total of 33 patients who were admitted through our department died as a result of trauma during the year (excluding elderly patients with fractured neck of femur). The audit panels thought that the deaths of only three of these patients (9%) could have been prevented. In all three the audit panels identified mistakes made in the accident and emergency department that may have contributed to the patient's death.

Discussion

Accidents are recognised as the leading cause of death in young adults and the third commonest cause

among all ages both in the United Kingdom and the United States.^{7,8} The impact of trauma on Western society in terms of cost, lives lost, and disability created is substantial, and different measures have been introduced in an attempt to solve the problem. These include the introduction of accident and emergency departments in Britain and the development of trauma surgery as a specialty in America, which has been associated with the creation of trauma centres. Retrospective analysis of deaths from trauma both in the United States and in England have shown that many deaths are considered preventable.⁹ The introduction of a regional trauma care system in the United States has had considerable benefit in improving patient care.¹⁰

The management of the seriously injured patient is a challenging and often complex problem, and optimal treatment can really be expected only under optimal conditions. The audit of patient management in our department in 1981-2 showed that mistakes occurred in 58% of cases and that they were often attributable to inexperience. We therefore introduced the revised trauma score as a triage tool to ensure that senior accident and emergency doctors were called to manage patients with multiple trauma. As a result, senior accident and emergency staff participated in the management of over two thirds of seriously injured patients in 1987 as opposed to one sixth previously. Our results show that the error rate in patient management has dropped significantly, and our analysis indicates that this is largely due to the presence of senior staff. Even when this factor is adjusted for there seems to have been an improvement in treatment. It may be argued that this is due to the preregistration grade being phased out, but many of our junior staff had only one year of medical practice before their accident and emergency attachment, so there is now a higher degree of awareness in the junior staff of the principles of trauma management. There is now clearer and more effective teaching of the junior doctors concerning trauma care.

The fact that mistakes are still being made indicates the need for further improvements. Because only a small number of seriously injured patients present to the department it is difficult even for senior staff to achieve a high level of experience in trauma management.

Not all errors influenced the patient outcome. Our numbers are small, but our rate of 9% of preventable deaths is better than the rate of 20% found in the retrospective study by the Royal College of Surgeons working party.¹¹ We still fall short of the rates quoted for trauma centres in the United States, such as 1% in San Francisco in 1979¹² and 4% in Orange County, California, in 1983.¹³ Although we are moving in the right direction, we still have some way to go.

The report of the Royal College of Surgeons working party proposed that the only way to improve trauma care in Britain is to create trauma centres.¹⁴ This option may be the optimum choice, but creating this system will take time, and it may be impracticable in less populated regions. In addition, many hospitals will be designated as level 2 centres with the responsibility for initial treatment and later transfer of patients with life-threatening injuries to level 1 facilities. Until we have functioning level 1 centres we must strive to ensure maximum quality of care under the present system.

We acknowledge the help given in auditing the cases by the members of the audit panels: Mr W H Rutherford, Professor B J Rowlands, and Dr G Lavery.

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Medical audit data: counting is not enough

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Abstract

Objective—To assess the meaningfulness of a year's worth of audit data relating to all the inpatients of one consultant general surgeon and to question the usefulness of certain outcome measures.

Design—Analysis of records entered on to audit computer (Dunnfile) and relating to inpatient episodes for one consultant general surgeon over one year. Data obtained were compared with ward records and the patient administration system to check their accuracy.

Setting—The three hospitals and 12 wards in Brighton health district where the surgeon admitted patients.

Subjects—859 Records relating to inpatient episodes from 1 January to 31 December 1988. These covered 655 main procedures and 79 secondary procedures performed at the same time.

Main outcome measures—Procedures were analysed by complexity of operation (BUPA code) and grade of surgeon; complications were counted and rates constructed by surgeon and by BUPA code; returns to theatre were analysed.

Results—Simple counts revealed some data, such as the fact that one registrar performed more major operations (32) than the senior registrars (22 and 14), and an analysis of complications showed that he had a lower complication rate (11.4% v 20.0% and 19.4%). But the simple complication rate disclosed nothing about whether the complication was avoidable. Likewise, the number of returns to theatre needed further qualification. Analysis of data collection for February to April 1988 showed a 30% deficit of information on the audit system compared with ward records and prompted a re-examination of everyone's role in collecting data. After the year's audit there was still a 17% shortfall compared with the district's patient administration system, though some of this was accounted for by a backlog of work.

Conclusions—It is difficult to ensure adequate data collection and entails everyone in an unfamiliar discipline. Connecting the audit system to the patient administration system would help. Despite the limitations of crude analyses of workload and complication rates, the audit data helped to measure activity and in the management of the firm. Nevertheless, time and care have to be taken in presenting and interpreting audit data carefully.

Implications—Counting is not enough.

Introduction

Medical audit is a review of patient care.¹ It necessitates abstracting information from patient records and

making judgments about the quality of care given. These judgments are made by considering indicators of structure, process, and outcome.^{2,3} Conceptual problems abound, in part because we are dealing with a continuum. It is not clear where structure becomes process and process outcome. An oversimplistic, but nevertheless useful, distinction can be made. Structure audit involves analysing fixed resource inputs; process audit analysing investigations, procedures, and treatments; and outcome audit analysing the assessment of a patient's condition after an episode of treatment.

But what are these indicators of structure, process, and outcome? Can medical audit be used to judge the quality of care given? Several surgical units have reported the development of medical audit,⁴⁻⁹ but little has been written about the presentation and interpretation of audit data.

Medical audit data are the product of a complicated process. They are a static representation of dynamic processes. In the case of inpatients, for instance, there are many stages between admission and discharge, and medical audit attempts to intercept patients and events at different points along the "process continuum" and make counts. Evaluating these audit data is necessarily a complex exercise. Audit data alone cannot explain: they should be seen only as indicators, not final results. They describe what is there without providing an understanding of the underlying structure.

This paper reports some of the results of the first full year's audit of all inpatients for one consultant general surgeon, drawing particular attention to the problems of interpretation and the need for the careful presentation of data.

Background and method

Since 1985 CASPE Research (clinical accountability, service planning, evaluation) has worked closely with senior clinicians in Brighton on a series of projects funded by the Department of Health research management division to develop measures and information systems for quality assurance. The purpose of the research is to develop indicators of quality, tested by clinicians and other professionals, using self audit.

In September 1985 after careful evaluation of the audit software products on the market,¹⁰ Dunnfile was chosen to help with the routine auditing of consultants' inpatient workload. Dunnfile is a surgical audit software package developed by Mr D C Dunn, a general surgeon in Cambridge. It is used to collect a set of data on every inpatient admission which are used to generate discharge summaries and for surgical audit.

An analysis of all inpatient records relating to one consultant surgeon (RG) for the period 1 January 1988

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